Obesity Facts

Systematic Review

Obes Facts
DOI: 10.1159/000527540

Received: August 16, 2022
Accepted: September 21, 2022
Published online: November 8, 2022

EASO and EFAD Position Statement on Medical Nutrition Therapy for the Management of Overweight and Obesity in Children and Adolescents

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Keywords
Medical nutrition therapy · Obesity · Guidelines · Weight loss

Abstract

Introduction: This position statement on medical nutrition therapy in the management of overweight or obesity in children and adolescents was prepared by an expert committee convened by the European Association for the Study of Obesity (EASO) and developed in collaboration with the European Federation of the Associations of Dietitians (EFAD). ***Methods:*** It is based on the best evidence available from systematic reviews of randomized controlled trials on child and adolescent overweight and obesity treatment and other relevant peer-reviewed literature. ***Results:*** Multicomponent behavioural interventions are generally considered to be the gold standard treatment for children and adolescents living with obesity. The evidence presented in this position statement confirms that dietary interventions can effectively improve adiposity-related outcomes. Dietary strategies should focus on the reduction of total energy intake through promotion of food-based guidelines that target modification of usual eating patterns and behaviours. These should target increasing intakes of nutrient-rich foods with a lower energy density, specifically vegetables and fruits, and a reduction in

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intakes of energy-dense nutrient-poor foods and beverages. In addition, higher intensity, longer duration treatments, delivered by interventionists with specialized dietetic-related skills and co-designed with families, are associated with greater treatment effects. ***Discussion:*** Such interventions should be resourced adequately so that they can be implemented in a range of settings and in different formats, including digital or online delivery, to enhance accessibility.

Introduction

Obesity in children and adolescents is a global public health concern. Population-level surveillance studies use body mass index (BMI) as a proxy measure for adiposity-related diseases such as obesity. Both incidence and prevalence of BMI continue to increase with estimates that by 2025, 340 million 5–19-year-olds will have a BMI classified as overweight or obesity [1]. Between 2015 and 2017, the overall prevalence of combined overweight/obesity in the European region among 6–9-year-olds was 29% in boys and 27% in girls, including an obesity prevalence of 13% in boys and 9% in girls [2]. Data for 6–9-year-old children are extracted from the World Health Organization (WHO) European Childhood Obesity Surveillance Initiative (COSI), but there is no Europe-wide dataset for younger children [2]. There is a wide variation between countries, with some Mediterranean countries reporting that 40% of children are living with overweight and 14–24% with obesity [2]. The most rapid increases in prevalence have been in low and lower middle-income countries [3]. Evidence from Europe [4, 5] and globally [6] highlights that the COVID-19 pandemic precipitated changes in health behaviours and increases in BMI resulting in a spike in child and adolescent overweight and obesity incidence.

Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health [7]. In the European region, both the WHO and the International Obesity Taskforce (IOTF) definitions of overweight and obesity are used in addition to a number of country-specific growth references [8–10]. Weight status categories within these definitions reflect the age and gender-specific developmental and nutritional needs of children and adolescents. Treatment and management of children and adolescents with overweight and obesity are more complex than for adults due to dietary requirements varying with age and developmental stage, in addition to increasing autonomy in behavioural decisions with maturity onset [11]. Substantial progress has been made in recent years towards understanding the contributions of nutrition, weight status within a child developmental context and relative to metabolic, microbiome, and genetic factors [12].

Early life factors strongly influence children's eating behaviours and establish a "blueprint" for lifelong food preferences, and hence risk of developing overweight and obesity and other chronic diseases [13, 14]. Children's eating behaviours and parental feeding style can affect the likelihood of obesity development in childhood [15]. The "first, do no harm" philosophy should underpin all strategies to influence the dietary, physical activity, and sedentary behaviours of children and adolescents [16]. Weight-related stigma and bias are increasingly recognized as barriers to receiving treatment and support. Non-weight-centric approaches by treatment providers and in interventions have the potential to mitigate and mediate stigma and bias. It is important to raise awareness of the importance of focusing on improvement in healthy habits and quality of life rather than weight loss, along with psychological implications of obesity, while ensuring any comorbidities are prevented or managed [17].

Obesity is a multifactorial disease caused by health-disrupting environments, psycho-social, metabolic, behavioural factors, and genetic variants. In childhood and adolescence, obesity lays the foundation for obesity in adulthood and various related non-communicable diseases, impacting health and well-being throughout the life course [18, 19]. Therefore, public health initiatives for systematic early identification and treatment of overweight and obesity have been established in some countries [20]. Such initiatives align with national-level food and health policies, country-specific childhood nutrition, and weight management guidelines, and articulate with local programmes for children and adolescents identified as being at risk for overweight or obesity. Similarly, in the UK the National Institute for Health and Care Excellence (NICE) has published clinical guidelines for obesity identification, assessment, and management [21], and a specific lifestyle management service pathway for children and young people with overweight or obesity [22]. The National Health Service (NHS) has initiated services for children with obesity-related complications to receive specialist treatment and tailored healthcare as part of a long-term plan to reduce the need for more invasive treatment [23]. Guidelines for overweight and obesity treatment in the European region are country-specific, and currently, there are no overarching evidence-based

guidelines for dietary management or medical nutrition therapy (MNT) of overweight and obesity that are specific to children and adolescents [24]. The European Federation of the Associations of Dietitians (EFAD) and the European Association for the Study of Obesity (EASO) collaborated to conduct and publish a survey of the available guidelines for dietetic treatment of obesity across Europe [25]. Although several guidelines were identified, most European countries did not have guidelines based on the latest scientific evidence and lacked regular updates. In a follow-up survey, it was highlighted that dietitians often consult guidelines from other countries or regions when designing obesity treatment plans. There is a need for transversal guidelines that are applicable in all European countries that act as a platform for collaboration across countries and regions but allow for local adaptation based on the needs and priorities of each country/region [25].

The EASO Childhood Obesity Task Force (COTF) advocates for childhood obesity to be formally recognized as a chronic disease so that interventions and health policies for obesity prevention and treatment are prioritized at the societal and individual level, as they are for other chronic diseases in children and adolescents [26]. Globally, there is increasing recognition that children and adolescents are highly vulnerable to weight bias and stigma, impacting their health and well-being as well as obesity treatment outcomes. "Weight bias" refers to negative individual attitudes and beliefs about people living with obesity. Social stereotypes that people with obesity are lazy, unintelligent, and lacking willpower are deeply ingrained in our society and can lead to stigmatizing practices and discriminatory actions [27].

Research indicates that weight stigma can impact physical health and mental health outcomes, as well as healthcare delivery [28, 29]. A growing body of evidence demonstrates that weight stigma may increase risk for all-cause mortality independently of weight or BMI status [30]. Experiences of weight stigma can be a driver and a barrier for obesity management in children and adolescents [31]. For example, there is evidence that individuals who experience weight stigma can internalize these weight biased beliefs and attitudes, meaning that they feel shame over their weight and bodies and can engage in unhealthy coping strategies such as unhealthy eating and avoidance of physical activity [32, 33]. Internalized weight bias has been associated with greater disordered eating patterns, depression, and greater cardiometabolic risk [34, 35].

Weight bias is highly prevalent among healthcare professionals, including dietitians [36]. Increasing awareness and knowledge among healthcare professionals about the uncontrollable and non-modifiable causes of obesity (genetics, biology, environment, socio-cultural influences) can decrease weight bias [37]. In addition, to shift the perception that obesity is simply a lifestyle choice and that individuals living with obesity are just lazy or lacking willpower to manage their own weight, it is important that clinical practice guidelines are aligned with the science of obesity [38]. The science of obesity stipulates that obesity is a chronic disease and that weight control is dependent on factors that are beyond an individual's food and physical activity behaviours [39]. Therefore, obesity care should include long-term interventions that focus on improving health and well-being, rather than weight loss alone. Reframing obesity as a chronic disease can be an important strategy to reduce weight bias and stigma for children, adolescents, and their families.

Published recommendations for the nutritional management of overweight and obesity in children and adolescents have been compiled by consolidating clinical practice guidelines from relevant jurisdictions or countries. The contributing guidelines are usually based on empirical evidence and previously published guidelines and informed by clinical expertise and expert opinion. A 2021 systematic review consolidated recommendations for nutritional management of paediatric overweight and obesity, and proposed a structured framework to guide dietary intervention [40], and a 2021 scoping review addressed dietetic management of paediatric obesity and severe obesity [24]. These evidence syntheses have contributed substantially towards defining and differentiating the dietary and nutrition components from other aspects of paediatric overweight and obesity treatment.

There is a need for comprehensive, age-appropriate, and evidence-based MNT guidelines for the treatment of obesity in children and adolescents. Such guidelines must align with the current understanding of obesity as a chronic disease that requires long-term care while focusing on improving health and well-being, rather than weight loss outcomes alone.

MNT is an evidence-based nutritional therapeutic approach used in the nutrition care process of treating and/or managing chronic diseases, in this case child and adolescent obesity. Individual MNT (IMNT) is usually conducted in a clinical or primary care setting, and includes nutrition assessment, diagnostics, therapy, and counselling. IMNT is implemented and monitored by a qualified dietitian in liaison with a physician. IMNT for a child with

overweight or obesity usually involves at least one parent and sometimes the whole family whereas with an adolescent, IMNT would usually primarily involve the individual themselves, but guidelines usually highlight the importance of parental involvement [41] despite little empirical evidence upon which to base these guidelines [42]. This position statement synthesized graded evidence from interventions, with a dietary component, for the treatment of overweight or obesity in children and adolescents, and then applied expert consensus to develop recommendations for IMNT. It primarily focuses on the effect of MNT, provided alone or together with other interventions, on dietary outcomes in children and adolescents receiving treatment for overweight or obesity. Its secondary focus is on adiposity outcomes, as in the majority of randomized controlled trials (RCTs) the MNT intervention is provided as part of a multicomponent treatment strategy where it is not possible to separate out the specific effect of the dietary intervention on the adiposity outcome.

Identifying and Applying Evidence from RCTs and Reviews of IMNT in Children and Adolescents Living with Overweight and Obesity

The process for evidence identification, grading, and recommendation development for this position statement is provided in Tables 1–3. The following considerations were accounted for in the process of applying evidence from interventions to this position statement and recommendations:

- Treatment of overweight and obesity differs between children, adolescents, and adults, with establishment of healthy behaviours prioritized rather than weight loss alone.
- IMNT generally involves a (decreasing) level of parental input with increasing child age or capability.
- Reference food-based dietary guidelines differ between countries depending on food availability, by age group and gender, and health status, to account for nutrient requirements for normal growth and development and for puberty in adolescence [43]. Thirty-three countries in Europe have published food-based dietary guidelines [43].
- Evidence contributing to this position statement is predominantly from between-group findings in RCTs in children and adolescents (up to 20 years of age) included in seven systematic reviews [40, 44–49] and an umbrella-style review of Cochrane reviews [50]. Within-group findings in RCTs that involved comparison of two interventions were considered and reported if clinically relevant to IMNT in order for healthcare professionals to benchmark against achievable individual-level dietary targets [51].
- Consolidated data were reviewed by childhood obesity academic and practicing dietetic experts from the University of Newcastle, EASO, and EFAD to derive implications and recommendations.

Influencing Total Energy Intake in MNT: High-Level (1a) Evidence

Meta-analysis of total energy intake in 29 RCTs (from a 2021 systematic review of 109 RCTs) involving those aged two to 20 years with overweight or obesity reported that intervention groups achieved significantly greater decreases in mean total energy intake compared to control groups at up to 6 months (−194 kcal/day, 95% CI: −275.80 to −112.90 kcal/day, $p < 0.001$) and up to 12 months (−112 kcal/day 95%, CI: −218.92 to −5.83 kcal/day, $p < 0.05$) but not at longer than 12-month follow-up (−19 kcal/day, 95% CI: −263.63 to 224.06, $p = 0.87$) [40]. In the same review, total energy intake reductions of up to 500 kcal per day from baseline to 6 and 12 months were reported in both intervention and comparator groups. Only 2% of these RCTs reported dietary intake as the primary outcome, so studies were possibly underpowered to detect dietary change [40].

A systematic review of very low energy diet (VLED) interventions (≤800 kcal/day or <50% energy requirements) reported that VLED programmes are effective for treating 5- to 18-year-olds with obesity, with greater weight loss reported in studies with adolescents that used nutritionally complete meal replacement (MR), and/or in inpatient settings. Meta-analysis of seven studies indicated 5.3 kg mean weight loss (CI: 2.5–8.0 kg, $p < 0.001$), and meta-analysis of five studies indicated a BMI reduction of 3.4 kg/m^2 (CI: 1.9–4.9 kg/m^2, $p < 0.001$) at follow-up (5–14.5 months from baseline). Meta-analysis also provided evidence of significant improvements in cardiometabolic outcomes including blood pressure, total cholesterol, blood glucose, and insulin levels [44]. Reporting on adverse events within studies was limited, and so, the safety of VLED in this context cannot be confirmed. Adverse events reported included fatigue, hunger, postural dizziness, nausea, muscle cramps, bad breath, and headache, although one study reported an intermittent sinoatrial block in one participant on day 7 and a life-threatening symptomatic arrhythmia (non-sustained ventricular

Table 1. Summary of processes for evidence synthesis and recommendation development [16, 17, 40–42, 44, 45, 47–50, 80, 105, 116, 117, 127, 128, 137, 142–147]

Processes
1. The NWG of the EASO identified, defined, and gained consensus on the scope of the guidelines (age range, geographic region, treatment approaches, context, evidence synthesis process, expert input) and the approach to guideline development. Under the EU Platform for Action on Diet, Physical Activity & Health the Platform, the EASO and the EFAD made a joint commitment to map and address the needs of healthcare professionals and policy-makers in the area of dietetic management of obesity. A standing committee was created from members of the NWG of EASO and the ESDN Obesity committee of EFAD, which included dietitians, physicians, and other health professionals. In the previous years, the committee had commissioned a series of reviews and surveys and collaborated with similar organizations abroad for knowledge exchange and promotion of international collaboration. Prior to the creation of the European Guidelines, the committee conducted and published a survey of the available guidelines for dietetic treatment of obesity across Europe.
2. EASO executive identified that a UON team has led and maintained a living JBI systematic review including RCT interventions, with a dietary component, aimed at decreasing adiposity in children and adolescents with overweight or obesity. The first systematic review in this series was published in 2007 [142] including studies published 1975–2003. The first update was published in 2013 including studies published 2003–2010 [143]. A protocol was published prior to the second update and including some changes to the databases searched and limited to RCTs given the prevalence of this study design in childhood obesity interventions [144]. The second update of the review was published in 2021 including studies published from 2010 to January 2020 [40]. This second update of the original review, by Duncanson et al. [40], focused on dietary outcome and included a synthesis of RCTs published since the original review in the series. This position statement predominately draws on evidence from the review by Duncanson et al. [40]. A critical appraisal of all RCTs included in Duncanson et al. [40] review was conducted using the JBI Critical Appraisal Tool for RCTs [145], with results and study characteristics published online [40]. The review series' literature search was updated in February 2021 and included 18 additional RCTS which are cited in this position statement. As the study characteristics, dietary outcomes, and critical appraisal data for these RCTs are not published elsewhere this is provided as an online supplementary File along with this position statement.
3. From the literature searches conducted by UON in 2020 and 2021, fourteen more reviews on MNT-related dietary factors and approaches (overweight and obesity treatment, children, and adolescents) were identified [41, 42, 44, 45, 47–50, 80, 105, 116, 117, 137]. The JBI Critical Appraisal Tool for Systematic Reviews and Research Syntheses [145] was used to appraise all reviews, and a summary of these results is provided in Table 2.
4. UON team, and EASO and EFAD representatives consolidated evidence from steps 2) and 3), including levels of evidence, implications, and recommendations. The method for determining levels of evidence was modified from Shekelle et al. (1999, 2012) [146, 147] for the development of the Canadian Adult Obesity Clinical guidelines: Medical Nutrition Therapy in Obesity Management (see Table 3) [17].
5. Evidence grading finalized using criteria modified from Shekelle et al. (1999, 2012) [127, 128] for the development of the Canadian Adult Obesity Clinical guidelines: Medical Nutrition Therapy in Obesity Management (see Table 3) [16].
6. UON team, and EASO and EFAD representatives prepared this position statement document for obesity facts.
7. Next step: Develop guideline document with graded evidence, based on evidence in position statement. This document will then be used to develop MNT recommendations based on evidence and expert consensus. MNT recommendations will be reviewed by HCPs and consumers to ensure fidelity and relevance, and then revised and reviewed. Before full implementation, external expert review will be conducted to further assess relevance, generalizability, and feasibility.

NWG, Nutrition Working Group; ESDN, European Specialist Dietetic Network; UON, University of Newcastle; JBI, Joanna Briggs Institute; HCPs, healthcare professionals.

tachycardia) in another participant on day 14, the latter attributed to electrolyte deficiencies after switching to a home-made formulation [44]. The review authors recommended that "a VLED programme for the treatment of a child or adolescent with obesity should only be implemented by trained health professionals with regular review to monitor safety, including expected adverse effects. A dietitian should also be consulted to ensure nutritional adequacy of either formula or food-based VLED programmes. Following the initial rapid weight loss phase, ongoing maintenance and support are likely to be required to prevent weight regain" [44].

Evidence statement 1 (GRADE A): Modest reductions in total energy intake within IMNT implemented by a qualified dietitian that are sustained for up to 12 months are achievable and can result in meaningful individual health improvements for children and adolescents with overweight or obesity [52]. Individual's energy intake requirements increase with age and also depend on physical activity levels, so they need to be regularly reviewed and adjusted.

Table 2. Critical appraisal of systematic and other reviews and RCTs

a Critical appraisal of systematic and other reviews included in this position statement

Author, year	What patient population is receiving the intervention?	What is in the intervention?	Outcome of interest?	Data from JBI tool used but linked to Table 3a criteria								Conclusion drawn from the paper
				does the paper report a comprehensive search or evidence? (JBI criteria 3, 4)		did the authors assess each article for validity? (JBI criteria 5, 6, and 8)		did the authors avoid bias in selecting articles for inclusion? (JBI criterion 9)	does the paper report clear conclusions that are supported by the data and appropriate analyses? (JBI criteria 10, 11)		final recommended evidence level	
Andela et al., 2019 [44]	Children and adolescents with obesity	VLED programme	Efficacy (weight-related outcomes) and safety	Y	Y	Y	Y	Y	Y	Y	Y	3–4 (included non-randomized studies)	VLED programme may be particularly useful for achieving weight loss in adolescents and more efficacious in an inpatient setting, administered as a formulated MR and when of a longer duration
Azevedo et al., 2022 [117]	Children and adolescents with overweight or obesity	E-health or m-health behaviour interventions	BMI or BMI z-score	Y	Y	Y	Y	Y	Y	Y	Y	1A	E-health interventions for treating overweight and obesity in children and adolescents are associated with significant effect on lowering BMI and BMI z-score
Bean et al., 2020 [42]	Adolescents with obesity	Behaviour or lifestyle RCTs with parental involvement	BMI or BMI z-score	Y	Y	Y	Y	Y	N/A	Y	Y	1B	Further research, with detailed reporting, is needed to inform clinical guidelines related to optimizing the role of parents in adolescent obesity treatment
Borello et al., 2015 [116]	Children (2–11 years)	MI quasi/experimental interventions aimed at children	BMI change	UC	Y	UC	UC	Y	N/A	Y	Y	3	MI can be applicable in the treatment of overweight and obese children, but its efficacy cannot be proved given the lack of studies carried out on this specific sample
Dougkas et al., 2019 [45]	Children and adolescents	Intakes of milk and other dairy products	Indicators of adiposity	Y	N	N	N	UC	N	Y	Y	3	Milk and other dairy products are consistently found to be not associated, or inversely associated, with obesity and indicators of adiposity in children. Adjustment for energy intake tended to change inverse associations to neutral. Also, we found little evidence to suggest that the relationship varied by type of milk or dairy product, or age of the children, although there was a dearth of evidence for young children
Duncanson et al., 2021 [40]	Children and adolescents with overweight or obesity	Dietary component of weight management interventions	Dietary intake	Y	Y	Y	Y	Y	Y	Y	Y	1A	Obesity interventions with a dietary component have a modest but sustained impact on reducing total energy intake and improving intakes of specific food groups in children and adolescents with overweight or obesity

Table 2 (continued)

Author, year	What patient population is receiving the intervention?	What is in the intervention?	Outcome of interest?	Data from JBI tool used but linked to Table 3a criteria									Conclusion drawn from the paper
				does the paper report a comprehensive search or evidence? (JBI criteria 3, 4)		did the authors assess each article for validity? (JBI criteria 5, 6, and 8)			did the authors avoid bias in selecting article for inclusion? (JBI criterion 9)	does the paper report clear conclusions that are supported by the data and appropriate analyses? (JBI criteria 10, 11)		final recommended evidence level	
Ells et al., 2018 [50]	Children and adolescents with overweight or obesity	Lifestyle interventions that delivered diet, physical activity, and behavioural interventions either as a single or multicomponent programme	Primary outcomes: BMI/BMI z-score, body weight, and adverse events	Y	Y	Y	Y	Y	Y	Y	Y	1A	Collectively, the evidence suggests that multicomponent behaviour changing interventions may be beneficial in achieving small reductions in body weight status in children of all ages, with low adverse event occurrence reported
Gow et al., 2014 [137]	Children and adolescents with overweight or obesity	Diets with varying macronutrient distributions	Changes in at least one weight-related outcome (i.e., weight, BMI [raw or z-score], or body composition) with or without investigation of cardiometabolic risk factors	Y	Y	Y	Y	Y	UC	Y	Y	2	Current evidence suggests that improved weight status can be achieved in overweight or obese children and adolescents irrespective of the macronutrient distribution of a reduced energy diet
Hoare et al., 2021 [47]	Adolescents with obesity	VLEDs, low carbohydrate diets, and intermittent energy restriction	Safety, weight-related outcomes, and cardiometabolic outcomes	Y	N	N/A	N/A	Y	N/A	Y	Y	4	Emerging evidence on the use of these novel dietary interventions demonstrates short-term weight-related and cardiometabolic improvements. While the evidence is encouraging, and no serious adverse effects have been reported, monitoring of intervention safety is essential
Kobes et al., 2018 [105]	Children and adolescents	Meta-synthesis of meta-analyses of effectiveness of interventions for CAOO	BMI, BMIz, prevalence of overweight/obesity, waist circumference	Y	Y	Y	Y	Y	Y	Y	Y	1A	Interventions result in statistically significant effects albeit of relatively little clinical relevance
Lu et al., 2016 [48]	Children and adolescents	Any type of dairy products such as white milk (e.g., cow's milk, sheep's milk, and goat's milk), flavoured milk, cheese, yogurt, and ice cream made with dairy and other dairy desserts (e.g., pudding)	Risk of over-weight/obesity, changes in PBF or BMI gain	Y	Y	Y	UC	Y	Y	Y	Y	3	Accumulated evidence from prospective cohort studies suggests that dairy consumption is inversely and longitudinally associated with the risk of childhood overweight/obesity. Further studies are warranted to examine the types of dairy products in relation to the risk of childhood overweight/obesity

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Table 2 (continued)

Author, year	What patient population is receiving the intervention?	What is in the intervention?	Outcome of interest?	Data from JBI tool used but linked to Table 3a criteria									Conclusion drawn from the paper
				does the paper report a comprehensive search or evidence? (JBI criteria 3, 4)		did the authors assess each article for validity? (JBI criteria 5, 6, and 8)		did the authors avoid bias in selecting article for inclusion? (JBI criterion 9)		does the paper report clear conclusions that are supported by the data and appropriate analyses? (JBI criteria 10, 11)		final recommended evidence level	
Shrewsbury et al., 2011 [41]	Children and adolescents	Synthesis CPGs/ consensus/position/ recommendation statements: clinical management of pre-adolescent or adolescent obesity or overweight	Overweight and obesity: role of parents in treatment; recommendations to health professionals; deficiencies in literature and recommendations for future research	Y	Y	N/A	N/A	Y	N/A	Y	Y	1B	Emphasized importance of involving parents or family in paediatric overweight and obesity treatment; 1/3 provided separate recommendations on the role of parents/family for pre-/adolescents; ~1/2 contained recommendations to health professionals regarding interactions with parents. High-quality research on age-specific techniques to optimize the involvement of parents and family members needed
Steinbeck et al., 2018 [49]	Adolescents with obesity	Behaviour management and adjunctive therapies	Obesity	N/A	N/A	UC	UC	UC	UC	Y	Y	4	The importance of effective management of adolescent obesity is underscored by its high prevalence in many countries and the short-term and long-term impacts of the condition. More pragmatic clinical trials in young people are needed
Tomayako et al., 2021 [80]	Children (3–12 years)	Review and MA of obesity prevention and treatment	Child weight or weight status (e.g., BMI, BMI z-score, BMI percentile, weight)	Y	Y	Y	Y	Y	Y	Y	Y	1A	Parent involvement appears to be a beneficial component of nutrition- and physical activity-focused interventions for the prevention and treatment of overweight and obesity among children aged 3–12 years old

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Table 2 (continued)

b Critical appraisal of RCTs included in position paper and not published elsewhere

Author, year	What patient population is receiving the intervention?	What is in the intervention?	Outcome of interest?	Data from JBI tool used but linked to Table 3b criteria						Conclusion drawn by authors
				were patients randomly allocated to treatment groups? (JBI criterion 1)	was follow-up at least 80% complete? (extracted data)	was the assessment and adjudication of outcomes blinded? (JBI criterion 6)	were the patients analysed in the treatment groups to which they were assigned? (JBI criterion 9)	was the sample size large enough to detect the outcome of interest?	final evidence level	
Akgul Gundogdu et al., 2018 [111]	Adolescents with overweight and obesity	Solution-focused approach interview technique regarding nutrition – exercise attitudes, and behaviours	Anthropometric and metabolic indicators	Y	Y	N	N	Y	2	The intervention led to positive development of nutrition – exercise attitudes and behaviours; significant decrease in weight, BMI percentile, BMI-SDS values, and normal metabolic values
Amiri et al., 2020 [112]	Adolescents with overweight and obesity	Motivation-based programme or a conventional dietary counselling	Anthropometric, metabolic, behavioural, and health-related quality of life indicators	Y	N	U	Y	Loss to follow-up was greater than predicted	2	The motivation-based programme was more effective in reducing adolescents' wrist circumference and improving HRQoL
Armeno et al., 2011 [59]	Adolescents with obesity	Two low energy diets: (1) reduced glycaemic index and (2) a CD	Anthropometric and metabolic indicators	Y	Y	U	U	Sample size calculation not reported	2	Lower GI diet reduced insulin resistance and waist circumference more than CD
Banks et al. [124]	5–16-year-olds with obesity	Hospital-based childhood obesity clinic versus nurse-led clinic in a primary care setting	Anthropometry, quality of life, and satisfaction	Y	N	U	Y	This was a pilot study	2	Primary care is a clinically appropriate setting and acceptable to families. Based on the primary outcome (BMI-SDS), the primary care intervention was not inferior to the hospital-based intervention
Berkowitz et al., 2011 [133]	Adolescents with obesity	Diet including MRs versus lifestyle programme with isocaloric CD	Anthropometric, metabolic, psychological, and behavioural measures	U	N	U	Y	Sample size calculation not reported	2	MR use significantly improved short-term weight loss compared with CD, but continued MR use did not improve weight loss maintenance
Berkowitz et al., 2013 [125]	Adolescents with a BMI >28 kg/m^2	Self-guided LMP versus group LMP	Anthropometry	Y	N	U	Y	Sample size calculation not reported	2	Both interventions were significantly effective in reducing BMI. Self-guided LMP is an innovative approach for primary care
Jensen et al., 2013 [107]	Children and adolescents with obesity and asthma	500-kilocalorie/day energy reduction from individually calculated age- and gender-appropriate energy requirements or control	Anthropometric and metabolic indicators, lung function	Y	Y	U	Y	Sample size calculation not reported (pilot)	2	The dietary intervention induced acute weight loss in participants
Köse et al., 2021 [114]	Adolescents with overweight and obesity	A motivational support programme	Anthropometric, metabolic, quality of life indicators	Y	Y	N	N	Unclear	2	The motivational support programme positively affected adolescents' health

Table 2 (continued)

Author, year	What patient population is receiving the intervention?	What is in the intervention?	Outcome of interest?	Data from JBI tool used but linked to Table 3b criteria						Conclusion drawn by authors
				Were patients randomly allocated to treatment groups? (JBI (criterion 1)	Was follow-up at least 80% complete? (extrac-ted data)	Was the assessment and adjudication of outcomes blinded? (JBI criterion 6)	Were the patients analysed in the treatment groups to which they were assigned? (JBI criterion 9)	Was the sample size large enough to detect the outcome of interest?	Final evidence level	
Larsen et al., 2015 [120]	5–9-year-olds with overweight	Health consultations in general practice over 2 years versus same intervention plus an educational programme for children and families	BMI z-score and other anthropometry measures	Y	Y	Y	Y	Y	2	Both intervention strategies did not differ significantly with regard to change in BMI z-scores
O'Brien et al., 2010 [134]	Adolescents with a BMI >28 kg/m^2	Supervised lifestyle intervention versus gastric banding	Anthropometry, metabolic indicators, quality of life, and adverse outcomes	Y	Y	N	Y	Y	2	Gastric banding resulted in a greater percentage achieving a loss of 50% of excess weight, corrected for age, compared with lifestyle intervention
Parillo et al., 2012 [60]	Children with overweight or obesity	Hypocaloric low GI (GI: 60) or hypocaloric high GI diet (GI: 90)	Anthropometric and metabolic indicators	U	Y	U	U	Sample size calculation not reported	2	A hypocaloric LGI diet has beneficial metabolic effects in comparison with a hypocaloric HGI diet in obese children
Parra Medina et al., 2015 [122]	Hispanic children or adolescents with overweight or obesity	Behavioural intervention versus standard care	Anthropometry	Y	Not reported but used ITT in analysis	Y	Y	This was a pilot study	2	The study provides preliminary evidence for feasibility of this primary care-based intervention in promoting weight maintenance in a high-risk population
Partsalaki et al., 2012 [58]	Children and adolescents with obesity	Ketogenic versus hypocaloric diet	Anthropometric and metabolic indicators	U	N	U	N	Sample size calculation not reported	2	Ketogenic diet led to greater reductions in weight and metabolic parameters compared with a hypocaloric diet
Resnicow et al., 2015 [123]	2–8-year-old children with overweight	MI with provider and dietitian versus MI with provider only versus standard care	Anthropometry	U	N if based on patients. Y if based on practices	N	Y	Y	2	MI delivered by providers and dietitian resulted led to statistically significant reductions in BMI percentile
Safavi et al., 2013 [131]	Children and adolescents with overweight or obesity	Synbiotic versus placebo	Anthropometry, metabolic indicators, dietary intake	U	Y	U	N	Y	2	The decrease in BMI z-score, waist circumference, and waist-to-hip ratio were significantly greater in the synbiotic group than in the placebo group. The synbiotic group had significant decrease in serum triglycerides, total and low density lipoprotein-cholesterol levels

Table 2 (continued)

Author, year	What patient population is receiving the intervention?	What is in the intervention?	Outcome of interest?	Data from JBI tool used but linked to Table 3b criteria						Conclusion drawn by authors
				Were patients randomly allocated to treatment groups? (JBI (criterion 1)	Was follow-up at least 80% complete? (extracted data)	Was the assessment and adjudication of outcomes blinded? (JBI criterion 6)	Were the patients analysed in the treatment groups to which they were assigned? (JBI criterion 9)	Was the sample size large enough to detect the outcome of interest?	Final evidence level	
Small et al., 2014 [118]	Preschool/early school-aged children with overweight and obesity	Parent-focused, multifaceted intervention conducted in a traditional office setting versus parallel intervention targeting general health and safety goals	Anthropometric indicators	U	N	U	U	It was a pilot study	2	Children in the experimental reduced waist circumference and waist-by-height ratio immediately following the intervention that persisted for 3 and 6 months. BMI and BMI percentile were not differentially effected
Taveras et al., 2011 [115]	Children with overweight and obesity	Families received MI by clinicians and educational modules targeting TV viewing, fast food, and SSB intake versus usual care	Anthropometric and behavioural indicators	Y	Y	U	Y	Not reported. It was a cluster RCT in primary care practices	2	After 12 mo, the intervention was effective in reducing television viewing but did not significantly reduce BMI
Verduci et al., 2021 [126]	Children with BMI z-score>2	Individual- versus collective-based nutritional lifestyle intervention	Atherogenic plasma index and other metabolic indicators, BMI	Y (but a potential source of bias was identified)	Y	U	N	Y	2	An individual-based nutritional and lifestyle intervention could have an additional beneficial effect over a collective-based intervention, although the actual size of the effect remains to be clarified

CD, conventional diet.

Table 3. Alignment and modification of evidence grading criteria for meta-analyses, systematic reviews and RCTs included in position paper

a Alignment and modification of evidence grading criteria for meta-analyses and systematic reviews included in position paper

Shekelle et al. [40] (1999, 2012) appraisal criteria used in Canadian Adult Obesity Clinical Practice guidelines [146, 147]	Response options	JBI criteria used in Duncanson et al. [40] systematic review of RCTs that reported dietary outcomes of interventions for children or adolescents with overweight or obesity	Response options
Does the paper report a comprehensive search or evidence?	Yes, No	JBI criteria 3. Was the search strategy appropriate? JBI criteria 4. Were the sources and resources used to search for studies adequate?	Yes, No, Unclear, Not applicable Yes, No, Unclear, Not applicable
Did the authors avoid bias in selecting articles for inclusion?	Yes, No	JBI criteria 5. Were the criteria for appraising studies appropriate? JBI criteria 6. Was critical appraisal conducted by two or more reviewers independent? JBI criteria 8. Were the methods used to combine studies appropriate?	Yes, No, Unclear, Not applicable Yes, No, Unclear, Not applicable Yes, No, Unclear, Not applicable
Did the authors assess each article for validity?	Yes, No	JBI criteria 9. Was the likelihood of publication bias assessed?	Yes, No, Unclear, Not applicable
Does the paper report clear conclusions that are supported by the data and appropriate analyses?	Yes, No	JBI criteria 10. Were recommendations for policy and/or practice supported by the reported data? JBI criteria 11. Were the specific directives for new research appropriate?	Yes, No, Unclear, Not applicable Yes, No, Unclear, Not applicable
If answers are "Yes" to all the questions: level 1 If any of the above questions is "No," assign paper: level 2		Total numbers for each response option reported	

b Alignment and modification of evidence grading criteria for RCTs included in position paper

Shekelle et al. (1999, 2012) appraisal criteria used in Canadian Adult Obesity Clinical Practice guidelines [146, 147]	Response options	JBI criteria used in Duncanson et al. systematic review of RCTs that reported dietary outcomes of interventions for children or adolescents with overweight or obesity	Response options
Large RCTs (defined as 100 or more participants) included	Not applicable	All RCTs regardless of sample size were included	Not applicable
Were patients randomly allocated to treatment groups?	Yes, No	JBI criterion 1. Was true randomization used for assignment of participants to treatment groups?	Yes, No, Unsure
Was follow-up at least 80% complete?	Yes, No	Source: data extraction spreadsheet	Yes, No, Unsure
Were both the patients and the investigators blind to the treatment the patient received OR if not feasible, was the assessment and adjudication of outcomes blinded?	Yes, No	In dietary intervention studies, with the exception some of trials where meals or supplements are provided, it is usually not feasible or practical to blind investigators or patients to the MNT component of their treatment. Therefore, only JBI criterion 6 was used. Were outcome assessors blind to treatment assignment?	Yes, No, Unsure
Were the patients analysed in the treatment groups to which they were assigned?	Yes, No	JBI criterion 9. Were participants analysed in the groups to which they were randomized?	Yes, No, Unsure
Was the sample size large enough to detect the outcome of interest?	Yes, No	Only 2 RCTS from Duncanson et al. [24] were powered for a dietary outcome [125, 126] and could be graded as level 1A evidence. The other 107 RCTS were powered for an adiposity or metabolic outcome, or these details were not described and so are automatically graded level 2	N/A
If answers are "Yes" to all the questions, assign paper: level 1A If answers are "Yes" or "No" to all the questions, assign paper: level 1B If any answer is "No," assign paper: level 2 Non-randomized clinical trial (including meta-analysis or systematic review) scoping review, narrative review: level 3 Other (e.g., case series without controls, case report, expert opinion, etc.): level 4		Total numbers for each response option reported	

Influencing Macronutrient Proportions and Intakes in IMNT: Moderate-Level (1b) Evidence

Macronutrient Distribution

A 2014 systematic review, of 14 eligible randomized or quasi-RCTs, reported that improved weight status was achievable regardless of the macronutrient composition of a reduced energy diet in children or adolescents with overweight or obesity [46]. Consistent with these findings, decreased adiposity outcomes in children or adolescents have been reported when dietary fat or carbohydrate is reduced [53] or a diet that included a higher pro-

tein meal [54, 55] was compared to a control group. In studies that compared two methods of dietary macronutrient manipulation, such as low carbohydrate versus low fat, within-group analyses show both to be equally effective in reducing childhood adiposity indicators [56–58].

Across five RCTs, a low glycaemic index (GI) diet reduced adiposity outcomes compared to isocaloric [59, 60] or hypocaloric (but higher GI) dietary interventions [61]. In the context of broader lifestyle interventions, low glycaemic load interventions are as effective as interventions that modify macronutrient proportions and hypocaloric diets [62–64].

Dietary Fat

Decreased dietary fat proportions of 4–5% of total energy intake (both $p < 0.01$) have been reported at 4-month follow-up in two RCTs [65, 66]. Within-group decreases in dietary fat intake ranged from seven to 45 g per day at 3 to 5 months [67–71] to a decrease of 15 g per day ($p < 0.01$) at 12-month [72] and 24-month follow-up [73].

Carbohydrate

Food-based guidance or behaviour change strategies and daily carbohydrate targets have been reported to significantly decrease carbohydrate intake, although not all studies that included an intervention targeting daily carbohydrate intake reported a significant change [40]. Between-group differences in carbohydrate intake reported in five RCTs [53, 68, 69, 71, 72] included a decrease of 72 g per day at 12-month follow-up in a dietitian-facilitated group programme involving parents and children ($p < 0.01$) [72]. Within-group decreases of 71–91 g per day (both $p < 0.001$) at 2-month [70] and 72 ($p < 0.001$) to 73 ($p < 0.01$) grams per day at 6-month follow-up have been reported [74]. Three out of four RCTs [61, 62, 64, 75] that reported glycaemic load decreased this measure by between 22.4 g/1,000 kcal ($p < 0.001$) at 2 months [62] and 13.8 g/1,000 kcal ($p < 0.05$) at 3 months [64].

Protein

Although limited evidence exists from RCTs about how to influence protein intake, one study identified that a high-protein breakfast significantly reduced daily hunger ($p < 0.05$) [54] and in another study reduced hunger was sustained for up to 3 h post-meal compared to control ($p < 0.001$) [55]. Within-group decreases in protein of 15–20 g per day were reported at between 2-month [70] and 6-month follow-up [76].

Evidence statement 2 (GRADE A): Altering macronutrient proportions is achievable with use of food-based dietary guidance over periods of up to 12 months. There is little evidence to support targeting increasing or decreasing proportions of protein, fat, and carbohydrate in an isocaloric diet; however, an increased proportion of food-based protein and decreased GI or load is consistently associated with reduced total energy intakes.

Influencing Core Food Intake in IMNT – Moderate-Level (1b) Evidence

Vegetables and Fruit

One study examining the influence of vegetable and fruit intake on adiposity reported that a plant-based diet significantly decreased BMI percentile and BMI z-score at 4 weeks compared to a heart-healthy diet in children and adolescents aged 9–18 years with obesity and hypercholesterolemia [77]. Duncanson et al. [40] reported that 21 out of 34 RCTs (62%) that measured vegetable and/or fruit intake in weight management interventions in children and adolescents reported a statistically significant increase in vegetable and/or fruit consumption in an intervention arm of the study. Between-group increases in the reviewed RCTs ranged from 2.3 servings per day at 2-month follow-up [78] to 0.3 – 0.5 servings per day at 8–12-month follow-up [79, 80]. Fruit intake increases of one serving per day at 2-month follow-up [70] and 0.3 servings per day at 6-month follow-up [81] were reported in the intervention group in 5 RCTs. Significant within-group increases of 0.3–0.5 vegetable servings per day were reported at follow-up 3–12 months from baseline [70, 81–83]. Four RCTs reported a significant decrease in fruit juice intake, ranging from reduced fruit juice intake at 3 months in two intervention arms (−65 mL/day, −64 mL/day, both $p < 0.05$) [84, 85] to increased odds of the intervention group never or rarely consuming fruit juice (OR 2.5 [1.6, 3.8]) at 24 months [86].

Dairy Foods

Findings from RCTs that included dairy food-focused interventions [87, 88] indicate that recommending up to four servings of dairy per day as part of a healthy diet and exercise programme can reduce adiposity measures compared with a non-intervention control. In a systematic review that included 20 RCTs, 31 longitudinal cohort studies, and 43 cross-sectional studies, milk and other dairy products were consistently found not to be associated with obesity and indicators of adiposity in children, when adjusted for energy intake [45]. In a systematic review of prospective cohort studies, with each daily serving

increment in dairy consumption, percentage body fat was reduced by 0.65%, which was not significant (β = 0.65; 95% CI: −1.35, 0.06; p = 0.07), and overweight/obesity risk was 13% lower (OR = 0.87; 95% CI: 0.74, 0.98) [48]. Four RCTs reported increased dairy food intakes [70, 84, 89, 90], including between-group differences of 94 g per day at 2-month follow-up [70] and 194 g more milk per day at 6-month follow-up [89].

Whole Grains

Intake of grains increased by up to 1.4 servings per day in an intervention compared to control groups at 6-month follow-up [91]. From RCTs that reported increased fibre intake, one reported a between-group increase of 4 g per day ($p < 0.05$) [92], while intervention group increases ranged from 3.4 g per 1,000 kcal ($p < 0.05$) at 4 months [66] to 2.8 g per day ($p < 0.05$) at 6 months [74].

Meat

Fatty or processed meats were not well differentiated from lean meat intake in included RCTs that involved a dietary intervention, so implications for IMNT regarding meat consumption could not be drawn [40]. Associations between adiposity and dairy, whole grains, or meat intake were not reported in these studies.

Evidence statement 3 (GRADE A): There is a substantial body of evidence supporting a targeted approach to increasing specific core foods, or groups of foods, while simultaneously targeting reduced intake of energy-dense nutrient-poor (EDNP) foods. Any intentional increase in nutrient-dense foods like dairy intake needs to be offset by reducing EDNP foods as part of an isocaloric or hypocaloric diet. IMNT needs to be explicit in differentiating between "nutrient-dense" lean meat and reduced fat dairy foods and more highly processed or energy-dense meat and dairy food options in order to optimize diet quality, nutrient intakes and avoid excessive energy, saturated fat, free sugar, and sodium intakes.

Influencing EDNP Food and Drink Intake in IMNT: Moderate-Level (1b) Evidence

Two interventions reported improvements in adiposity outcomes as a result of reduced EDNP foods that are highly or ultraprocessed and contain added fat, salt, and sugar [93, 94]. Limiting EDNP food choices using a traffic-light system within a family-based intervention resulted in a significantly greater decrease in weight than the comparator group in one study [93]. A sugar-sweetened beverage (SSB)-focused intervention reported significantly lower increase in BMI (−0.57 kg/m^2, $p < 0.05$) and weight (−1.9 kg, $p < 0.05$) in the intervention compared with control group at 12-month follow-up [94]. Duncanson et al. [40] indicated that decreasing intake of total and specific EDNP foods is achievable and has the potential to reduce adiposity outcomes as part of MNT. Seventeen of the 40 RCTs that measured intake of EDNP foods in their review reported a statistically significant between-group decrease in EDNP food intake. Significant between-group effects (intervention vs. comparator group) on total EDNP food intake (n = 5 RCTs) included reduced high fat/sugar foods by 0.9 servings per day (−1.4 vs. −0.5 servings/day, $p < 0.01$) at 6 months [91] and improved ratio of nutrient-dense to EDNP foods at 24 months (−0.9 vs. −3.1, $p < 0.05$) [95]. Significant within-group decreases in proportion of EDNP (n = 9 RCTs) that are relevant to IMNT include an 8% ($p < 0.01$) decrease in total energy intake from EDNP at 12 months [96] and a 7% ($p < 0.01$) decrease at 24-month follow-up [82]. Within-group decreases in total or specific EDNP food servings (−0.5 to −2.0 servings/day) were reported at 2–3 months in two RCTs [97, 98] and 6–12 months in four RCTs [81, 99–101]. Strategies to "swap" EDNP for nutrient-dense foods and targeting specific EDNP food items were effective and are readily applicable to IMNT involving children and adolescents with overweight and obesity.

The systematic review on dietary outcomes from interventions for children and adolescents with overweight or obesity reported decreased intakes of specific "savoury" and "sweet" EDNP foods [40]. These included 0.5 fewer servings of fast food per week (−0.17 vs. + 0.28, $p < 0.05$) [102] and less fried foods at 12-month follow-up (−0.3 servings/day, $p < 0.05$) [103]. Significant between-group decreases in sugar intake ranged from −48 g/day at 4 months ($p < 0.05$) and −105 g/day at 12 months ($p < 0.001$) to −58 g/day at 24-month follow-up ($p < 0.01$) in an intervention that replaced sugar-sweetened with noncaloric beverages in the home [94]. Twenty of 28 RCTs (71%) in Duncanson et al. [40] that measured SSB intake reported a significant decrease between 0.3 and 1.5 servings per day at 4–24-month follow-up. Seven studies targeted reducing SSB intake as a specific dietary intervention strategy, and one targeted increased water intake. In that study, a strategy aimed at increasing water intake to eight cups a day resulted in an increase in water intake from 2.0 (95% CI: 1.4–2.7) to 4.8 cups (95% CI: 3.8–5.9, $p < 0.0001$) in the intervention arm at 6-month follow-up [104].

Evidence statement 4 (GRADE A): Decreased EDNP foods for up to 12 months is achievable, but sustained change in dietary intake beyond 12 months is not as commonly evaluated. It is feasible for children and adolescents to decrease savoury EDNP by 0.5 to one serving per day, total sugar intake by more than 50 grams per day, and SSBs by one serving per day and maintain these changes for up to 12 months.

Adiposity Outcomes from Multicomponent Interventions: Moderate (Level 1b) Evidence

A quantitative synthesis of 26 meta-analyses resulted in a statistically significant standardized mean difference in BMI of −0.12 (95% CI: −0.16, −0.08) [105]. Similarly, an integrated overview of six Cochrane systematic reviews of interventions for treating children and adolescents with overweight and obesity reported modest BMI z-score decreases between 0.04 and 0.4 units at a follow-up of 10–24 months from baseline [50]. Multicomponent interventions for children aged up to 6 years reported a change in BMI z-score between −0.4 units (95% CI: −0.6 to −0.2), 12–18-month follow-up to −0.3 units (95% CI: −0.4 to −0.1) at 2 years from baseline. In studies for children with mean age of 6 to 12 years, mean difference in BMI z-score was −0.04 units (95% CI: −0.15 to 0.08) at 10–24-month follow-up and for adolescents aged 13–18 years, and the change in BMI z-score was −0.13 units (95% CI: −0.21 to −0.05). A review by Steinbeck et al. [49] reported that interventions in adolescents aged 12–15 years had a 41% lower odds of achieving successful weight reduction and maintenance compared to interventions in children aged 5–11 years, indicating the need for intervention initiation at a younger age.

Comparison and consolidation of adiposity outcomes from diet or diet-lifestyle interventions are limited by heterogeneity in study characteristics, including control or comparator groups. In 12–16-year-olds with obesity and asthma, a 28-week normocaloric diet (i.e., based on normal requirements for height and meal planning) compared with an "ad libitum" diet control group (2,231 ± 231 kcal vs. 3,243 ± 278, $p < 0.001$) resulted in a 0.5 unit decrease in BMI z-score (2.18 ± 0.3–1.66 ± 0.2 vs. 2.17 ± 0.2–2.12 ± 0.3, $p < 0.01$) and significant weight loss (−2.5 ± 1.3 kg vs. + 1.6 ± 1.3 kg, $p < 0.03$) [106]. In 8–17-year-olds, also with obesity and asthma, BMI z-score decreases of −0.2 [−0.4, −0.1] versus 0.0 [−0.1, 0.0, $p < 0.05$] were reported after a 10-week hypocaloric diet (target of −500 kcal/day) compared with the waitlist control group [107]. Mendes et al. [108] reported significant decreases in adiposity outcomes at 6 months with 500 kcal intake deficit from both fixed diet plan and a calorie counting diet plan. A further 18 interventions that combined a dietary intervention with interventions targeting physical activity or behaviour modification reduced at least one, and usually several adiposity indicators, compared with a non-intervention control [40]. It was not possible to determine the independent influence of diet on adiposity within these multicomponent lifestyle interventions.

Evidence statement 5 (GRADE A): Decreased adiposity outcomes are achievable following sustained modest to moderate energy intake deficit. The majority of interventions to date have focused on children and adolescents with obesity rather than overweight. Earlier identification of children and adolescents with overweight or obesity may support earlier treatment and improved health outcomes [40].

Intervention Delivery Factors in IMNT: Moderate-Level (1b) Evidence

Parental Involvement in Intervention

In their 2021 systematic review of dietary outcomes of RCTs for children or adolescents with overweight or obesity, Duncanson et al. [40] concluded that some intervention characteristics and strategies were common across age groups and some were age group specific. Universal characteristics included goals for nutrient adequacy, optimal growth, and age-appropriate food and eating behaviours. Interventions that focused on younger children (<5 years), generally involved similar strategies for children of any weight status, monitored growth and aimed to influence feeding behaviours of parents. For children aged five to 12 years, interventions involved more specific strategies for children identified as above 85th BMI percentile and included some child-specific components in addition to parent- and family-focused strategies. Adolescent-focused interventions involved some elements (and transitioning towards) adult-type management, with less parental focus and with some interventions involving MRs, medication, or bariatric surgery.

In their 2018 integrative review, Ells et al. [50] differentiated adiposity outcomes by age group and reported similar BMI z-score outcomes in parent-only and parent-child interventions aimed at 6–12-year-old children and similar outcomes in adolescent-only or adolescent-parent interventions for 12–18-years-olds. Two RCTs com-

paring parent-only interventions with a waiting list control reported a statistically significant change in BMI z-score in the intervention at 10–12-month follow-up (−0.10 units: 95% CI: −0.19 to −0.01). A parent-only intervention for 4- to 6-year-olds reported significant between-group difference in adiposity compared to a less intensive standard treatment involving parent and child [50]. An umbrella review that included 14 systematic reviews and/or meta-analyses supports the inclusion of a parental component in interventions to improve the weight outcomes of children aged three to 12 years. The authors concluded that evidence to guide the optimal type, intensity, and method of parent involvement was lacking [80]. Similarly, a systematic review that identified 23 studies reporting on behavioural lifestyle interventions that involved parents of adolescents with obesity was unable to conclusively recommend roles or elements of parental involvement because few RCTs experimentally manipulated parent involvement and reporting of interventions, adherence, and specific parent-related outcomes was unclear [42].

Lifestyle or Diet and Physical Activity Interventions

The majority of lifestyle interventions that incorporate a dietary component report a reduction in at least one adiposity indicator compared with a non-intervention control; however, the independent influence of diet on adiposity cannot be differentiated in these studies [109]. A combined diet-physical activity intervention resulted in a significantly greater decrease in adiposity compared with the same physical activity intervention alone in two RCTs [82, 110]. Burrows et al. [82] also reported that a diet-only intervention decreased BMI z-score more than the physical activity intervention.

Psychological or Motivational Interviewing Component

Psychological components in interventions for children or adolescents with overweight or obesity predominantly involve motivational interviewing (MI) conducted by a health professional with psychological or therapeutic patient education training. Approaches reported to result in a significant between-group difference in adiposity outcomes include a 6-month nurse-led solution-focused intervention (−2.6 to −11 kg vs. 2.9–9.0 kg, $p < 0.01$) [111] and a 6-month nutritionist-led MI intervention (BMI 29.91 ± 3.42–27.25 ± 2.79 kg/m^2 vs. 30.29 ± 3.65 vs. 30.81 ± 3.41 kg/m^2, $p = 0.001$) [112] with two other studies reporting a within-group reduced BMI z-score from a MI intervention [113, 114]. In an RCT involving 475 families including children aged 2–6 years with overweight or obesity, MI participants had a smaller, non-significant increase in BMI (−0.21 kg/m^2; $p = 0.15$), and non-significant but greater decreases in fast food (−0.16 servings/week; $p = 0.07$) and SSBs (−0.22 servings/day; $p = 0.15$) [115].

Three out of six included studies in a 2015 review of MI in childhood obesity treatment reported positive results on BMI, eating habits, and lifestyle change. Overall, this review cautioned that the efficacy of MI in the treatment of obese children required further research before it could be considered empirically evidenced [116].

E-Health Component

E-health interventions that have been used in interventions for children and adolescents with overweight or obesity include social media interactions, internet-based programmes, text messaging, website, online games, e-health meal planning tools, telemedicine, tablet or smartphone application, wrist device to measure energy expenditure, and a device that trains individuals to eat more slowly. These methods have demonstrated feasibility, with some reporting improved adiposity outcomes, especially in participants who report high engagement with the e-health intervention [40]. Meta-analysis of 16 comparable studies in a systematic review of e-health interventions for children and adolescents with overweight or obesity showed a small but statistically significant difference favouring the e-health intervention groups compared with controls (standardized mean difference −0.31, 95% CI: −0.49 to −0.13, $p < 0.001$) [117].

Intervention Settings

Primary care-based weight management interventions for children up to 14 years of age can lead to short [118] and longer term (up to 24 months) decreases in measures of adiposity [119, 120]. More intensive interventions have been reported to result in enhanced outcomes [121, 122]. A 24-month intervention in a primary care setting, including MI delivered by both the primary care provider and a dietitian, led to greater decreases in BMI percentile compared with usual care (−4.9 ± 0.99 vs. 1.8 + 0.98, $p < 0.05$) [123]. A multidisciplinary intervention for children and adolescents aged 5–16 years with a BMI percentile of 98 or higher implemented that was translated from a tertiary to primary care setting was equally as effective in reducing BMI standard deviation score (SDS) at 12-month follow-up (−0.15 ± 0.25 vs. −0.17 ± 0.26) [124]. A 12-month self-guided lifestyle modification programme (LMP) for 169 adolescents implemented primarily in the

home (with 6 clinic visits) and a 12-month intensive family-based lifestyle modification curriculum provided in primary care were both effective in reducing mean (SE) adiposity (−1.31 (0.05)% versus −1.17 (0.99)%) [125].

Interventionist

Secondary analysis of dietary intervention features and dietary outcomes in the review by Duncanson et al. [40] identified that 67% of RCTs in which a dietitian-administered dietary interventions reported significant decreases in total energy intake compared to 43% (χ^2[1] 6.65, $p < 0.05$) that were not dietitian-administered [40]. Dietitians delivered a higher percentage of interventions that involved personalized dietary advice than other interventionists (69% vs. 42%, $p < 0.01$), and similar percentages of interventions that resulted in changes in SSB (26% vs. 31%), EDNP foods (46% vs. 47%), and core foods or nutrients (67% vs. 55%) [40].

Intervention Intensity

Adiposity outcomes have been compared specifically to programme intensity in some studies. Overall, group-based lifestyle programmes held once or twice per week for 10–24 weeks, targeting parent and child, can be efficacious in reducing child BMI z-score up to 24 weeks and sustain decreases in adiposity outcomes for up to a year [21, 51]. A 12-month nutritional lifestyle intervention for 153 6–12-year-old children and their parents that promoted a normo-caloric "healthy" diet and increased physical activity resulted in decreased BMI z-score at 12 months when delivered in a small group or individually (−0.59 vs. −0.37, $p < 0.0001$), but the decrease was significantly greater in the individual arm [126]. Longer term maintenance of multiple dietary changes post-intervention was more common in RCTs that involved provision of personalized dietary advice, although this finding appears to be consistent with follow-up duration [40].

Evidence statement 6 (GRADE A): Parent-focused interventions can result in a significant decrease in child adiposity measures when compared with a waitlist control group or standard care. Adding a parent intervention as an adjunct to a child-focused intervention may lead to greater reductions in child adiposity. These findings need to be considered in conjunction with age of children and the intervention intensity and duration, as independent effects cannot be differentiated.

Evidence statement 7 (GRADE A): Based on a small number of studies, dietary interventions enhance the reduction in adiposity outcomes that can be achieved by physical activity interventions, with evidence from one study showing that the deficit in BMI z-score was greater in a diet-only intervention compared with a predominately physical activity intervention. IMNT outcomes can be enhanced by including psychological components delivered by trained health professionals. E-health components can enhance intervention engagement, but there is limited evidence about their capacity to influence adiposity outcomes.

Evidence statement 8 (GRADE A): Combining clinic-based interventions with home-based intervention components that involve the whole family or using methods facilitated by technology to link participants with clinicians (e-health) or evidence-based resources has been recommended for future interventions [127], particularly given that the COVID-19 pandemic has highlighted the importance of providing appropriate treatments remotely [128].

Evidence statement 9 (GRADE A): Dietitians are trained health professionals qualified to deliver personally tailored MNT to individuals and their families as a strategy to improve dietary compliance, optimize nutrient intake adequacy, and achieve dietary intervention goals. The efficacy of behaviour change and MI intervention components indicate that dietitians who deliver behaviour change interventions should be experienced or deliver interventions with health professionals who have this skillset. Based on evidence from RCTs, adding parent-led intervention components (such as peer-mentoring or resource-sharing by trained parents) to complement dietitian-delivered MNT may enhance outcomes.

Evidence statement 10 (GRADE A): A combination of higher intensity, longer duration support, and more specialized dietetic-related skillset is associated with greater treatment effect, although it is not always possible to differentiate between the relative contribution of interventionist and intervention intensity in influencing adiposity outcomes.

Evidence for Approaches to Dietary Management of Overweight or Obesity (Specific to Adolescents Only) – Moderate-Level (1b) Evidence

Adolescence (10–19 years old according to WHO) is a life stage of increased autonomy that can be demonstrated through independent decision-making about food choices [129]. However, parents do continue to influence adolescents' dietary intake by role modelling dietary behaviours and through the home food environment [129]. Recognition of the impact of food in changing relation-

ship dynamics is an important consideration for dietary management of adolescents with overweight or obesity.

More intensive dietary treatment approaches have been investigated for adolescents with obesity-related comorbidities, who require rapid weight loss or for whom conventional approaches have proven unsuccessful. These approaches align more to adult obesity treatments and included very low energy or low carbohydrate diets, intermittent fasting, MRs, dietary supplement medications, and bariatric surgery.

In their 2021 narrative review of novel interventions for adolescents with obesity, Hoare et al. [47] examined evidence from adult studies and 1 case series involving four children and adolescents that achieved a mean reduction of 0.19 BMI z-score post-intervention in adolescent patients. This review reported intermittent fasting to be potentially feasible, effective, safe, and sustainable, indicating that intermittent energy restriction could be a suitable treatment option in adolescents with obesity. Dietary modelling shows that intermittent energy-restricted meal plans can be designed to meet adolescents' micronutrient requirements with 3 days a week where energy is restricted to 2.5–2.9 MJ (600–700 kcal/day) [130].

Only two out of ten RCTs that examined paediatric adiposity outcomes from dietary supplement interventions reported reduced adiposity [131, 132], suggesting there is insufficient evidence of benefit beyond adjunctive caloric reduction or energy balance activity intervention. Similarly, a 12-month intervention involving provision of three MR shakes, one pre-packaged meal, and five fruit and vegetables served per day reduced adiposity in one intervention that involved adolescents [133].

Despite substantially greater adiposity reductions being reported in one RCT involving adolescents that compared gastric banding surgery to lifestyle modification [134], current recommendations support intensive dietary approaches such as VLED to prevent or delay the need for bariatric surgery [24]. Non-dieting approaches have been reported to improve some physical health measures, behavioural and psychological outcomes in adults with obesity [135]. Although little research into non-dieting approaches for adolescents has been conducted, the concepts of focusing on health-promoting behaviours at all stages of the medical nutrition care process, rather than a weight-centric approach, are consistent with clinical guidelines [49, 136]. Adolescent obesity treatment improves self-esteem and body image in the short and medium term, with improvement to self-esteem independent of weight-related outcomes [137].

Evidence statement 11 (GRADE A): There is not yet adequate evidence to support any one adolescent-focused dietary approach for management of overweight or obesity [47].

Limitations

The limitations to consolidating evidence on the treatment of children and adolescents with overweight or obesity for this position statement relate mainly to methodological factors within relevant studies, and the application of evidence from research to clinical practice. We acknowledge that IMNT-relevant strategies are often not well described between dietary-specific and lifestyle interventions that include a dietary component. In addition, evidence from RCTs and systematic reviews does not always translate to clinically relevant childhood obesity treatments in ways that can be implemented in real-world settings [51]. Other recognized limitations are the heterogeneity of study populations (individual, child-parent dyads, family, community, population) in interventions from which IMNT implications and recommendations are drawn, and the lack of evidence that is specific to people who are most in need of support in the real world such as families in crisis, living in food insecurity or with disability and those from diverse ethnic groups.

Contrary to research in adults, the treatment of obesity in children and adolescents is much less focused on identifying the importance of specific dietary patterns (e.g., Mediterranean diet, Nordic diet) in the process. Moreover, little research is conducted in areas such as the relevance of hydration in children and adolescent obesity. Beverage consumption in children is focused mainly on SSBs as intakes remain high in most countries [138]. A meta-analysis of RCTs and prospective cohorts did not support the switch to non-nutritive sweeteners as an effective tool for weight management; on the contrary, it highlighted a potentially positive association with increased BMI and cardiometabolic risk [139]. A focus on accessibility of drinking water at home and other locations seems to be a much more appropriate intervention if weight management is the goal [140]. Dietary patterns such as the Mediterranean diet have clearly incorporated hydration and access to drinking water in their guidelines, and there might be room for further research in the area of water consumption and/or accessibility and obesity treatment. Until then, it is important to highlight that according to the European Food Safety Authority (EFSA) water intake of 1,300 mL/day for boys and girls 2–3 years of age; 1,600 mL/day for boys and girls 4–8 years of age; 2,100 mL/day for boys 9–13 years of age; 1,900 mL for

girls 9–13 years of age is recommended. For adolescents, total water intakes of 2.0 L/day for females and 2.5 L/day for males are recommended [141]. Despite these limitations, this position statement does include the most rigorous and relevant current evidence about MNT in children and adolescents with overweight and obesity, which is predominantly based on high-quality dietary intervention data. Findings from the intervention studies were likely to involve less intensive IMNT or group-based nutrition therapy, so it would be expected that age-appropriate IMNT with more intensive, personalized intervention would result in more substantial changes to dietary intake.

Recommendations for MNT for Children and Adolescents with Overweight or Obesity Based on Level A Evidence

General recommendation: As a chronic disease, obesity in childhood and adolescence should be treated with both intensive and long-term care strategies. The focus of obesity management should be oriented towards improving patient-centred health outcomes, rather than weight maintenance or loss alone.

Recommendation 1: Long-term, regular individual dietitian-delivered MNT can result in maintenance of energy deficits that reduce adiposity indicators in children and adolescents with obesity, while maintaining nutritional requirements for growth [130].

Recommendation 2: It is recommended that IMNT for children and adolescents with overweight is focused on reduced energy density through increased vegetable consumption, adequate fruit intakes, and limited fruit juice consumption. Increasing children's fruit and vegetable intakes by 0.5 to 1.5 servings per day and maintaining increased intakes for at least 12 months are feasible. Dietary targets need to be tailored, with personalized dietary coaching to facilitate behaviour change and address barriers to improving dietary patterns, especially for increasing vegetable intakes.

Recommendation 3: Goal setting and guidance on intakes of targeted food groups or specific foods or drinks are associated with decreased servings and proportion of total energy from EDNP foods for up to 12 months. IMNT strategies should focus on simple but explicit, food-based guidance towards achieving country-specific guidelines and delivered as part of a behaviour change strategy.

Recommendation 4: Although weight status and weight change are predominantly influenced by total energy intake and expenditure, IMNT guidance and goal setting are more effective when focused on food-based guidance to improve nutrient intakes, rather than goal setting that is focused on nutrients or total energy intakes.

Recommendation 5: The level of parental involvement in MNT needs to be age-appropriate, transitioning from parent focused for children with overweight or obesity in the preschool years to adolescent-focused once children reach 12 years and older. It is prudent to conduct IMNT as part of a multicomponent intervention within a multidisciplinary team that includes physical activity and psychology-trained health professionals. Evidence-based e-health components that are developed or supported by trained health professionals may be useful for dietetic practitioners to complement IMNT.

Recommendation 6: Although the management of children and adolescents with overweight or obesity is usually conducted in tertiary clinics or primary care, settings can vary considerably based on country-specific health systems and service delivery models. With the development of home-based and e-health interventions, the service delivery can be reinforced and therefore may provide better access to quality care. Practitioners providing IMNT virtually need to carefully consider how to ensure all aspects of treatment and management are incorporated into interventions.

Recommendation 7: The therapeutic environment of IMNT affords healthcare professionals with a unique and important opportunity to mitigate psychological, social, and physical health consequences of overweight and obesity, including weight bias and stigmatization. Role modelling, appropriate non-stigmatizing person first language, and a safe, welcoming environment all contribute to optimal clinical care [49].

Conclusion

Multicomponent behavioural interventions are generally considered to be the gold standard treatment for children and adolescents living with obesity [50]. The evidence presented in this position statement confirms that dietary interventions can effectively improve their adiposity outcomes. Dietary strategies should focus on the reduction of total energy intake through promotion of food-based guidelines that target modification of usual eating patterns and behaviours. These should target increasing intakes of nutrient-rich foods with a lower en-

ergy density, specifically vegetables and fruits, and reducing intakes of EDNP foods and beverages. In addition, treatments that are of higher intensity, longer duration, with the dietary intervention delivered by interventionists with specialized dietetic-related skills and which target families, are associated with greater treatment effects. These should be resourced so that they can be implemented in a range of settings, including provision of digital or online delivery options to enhance accessibility. Therefore, the recognition of obesity as a chronic disease by public and private payers, health systems, the public, and media is essential to improve the access to quality ongoing care for children and adolescents living with obesity across the life course.

Statement of Ethics

An ethics statement is not applicable because this study is based exclusively on published literature.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Funding Sources

The current activity received no funding.

Author Contributions

Kerith Duncanson, Vanessa Shrewsbury, and Clare Collins: data synthesis and writing – first draft; Maria Hassapidou, Louisa Ells, Hilda Mulrooney, Odysseas Androutsos, Antonis Vlassopoulos, Ana Rito, Nathalie Farpourt, Tamara Brown, Pauline Douglas, Ximena Ramos Sallas, and Euan Woodward: writing – reviewing; all authors have read and approved the final version of the manuscript.

Data Availability Statement

Data can become available upon request.

References

1 World Obesity Federation. Global Obesity Observatory. [cited 2021 23 November]; Available from: https://data.worldobesity.org/.
2 World Health Organization. Childhood Obesity Surveillance Initiative. 2021 [cited 2021 24 November]; Available from: https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/activities/who-european-childhood-obesity-surveillance-initiative-cosi.
3 Colquitt JL, Loveman E, O'Malley C, Azevedo LB, Mead E, Al-Khudairy L, et al. Diet, physical activity, and behavioural interventions for the treatment of overweight or obesity in preschool children up to the age of 6 years. Cochrane Database Syst Rev. 2016;3(3):CD012105.
4 Androutsos O, Perperidi M, Georgiou C, Chouliaras G. Lifestyle changes and determinants of children's and adolescents' body weight increase during the first COVID-19 lockdown in Greece: the COV-EAT study. Nutrients. 2021;13(3):930.
5 Pietrobelli A, Pecoraro L, Ferruzzi A, Heo M, Faith M, Zoller T, et al. Effects of COVID-19 lockdown on lifestyle behaviors in children with obesity living in Verona, Italy: a longitudinal study. Obesity. 2020;28(8):1382–5.
6 Cena H, Fiechtner L, Vincenti A, Magenes VC, De Giuseppe R, Manuelli M, et al. COVID-19 pandemic as risk factors for excessive weight gain in pediatrics: the role of changes in nutrition behavior. A narrative review. Nutrients. 2021;13(12):4255.
7 World Health Organisation. Health topics: obesity. 2022 [cited 2022 1 Aug]; Available from: https://www.who.int/health-topics/obesity#tab=tab_1.
8 Monasta L, Lobstein T, Cole TJ, Vignerova J, Cattaneo A. Defining overweight and obesity in pre-school children: IOTF reference or WHO standard? Obes Rev. 2011;12(4):295–300.
9 de Onis M. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007;85(09):660–7.
10 World Health Organization. World Health Organization Child Growth Standards. 2006. [2012 24 November, 2021]; Available from: https: //www.who.int/toolkits/child-growth-standards.
11 Smith JD, Egan KN, Montano Z, Dawson-McClure S, Jake-Schoffman DE, Larson M. A developmental cascade perspective of paediatric obesity: a conceptual model and scoping review. Health Psychol Rev. 2018;12(3):271–93.
12 Llewellyn CH, Fildes A. Behavioural susceptibility theory: professor Jane Wardle and the role of appetite in genetic risk of obesity. Curr Obes Rep. 2017;6(1):38–45.
13 Boswell N, Byrne R, Davies PS. Eating behavior traits associated with demographic variables and implications for obesity outcomes in early childhood. Appetite. 2018;120:482–90.
14 Matvienko-Sikar K, Toomey E, Delaney L, Harrington J, Byrne M, Kearney PM. Effects of healthcare professional delivered early feeding interventions on feeding practices and dietary intake: a systematic review. Appetite. 2018;123:56–71.
15 Demir D, Bektas M. The effect of childrens' eating behaviors and parental feeding style on childhood obesity. Eat behaviors. 2017;26:137–42.
16 O'Dea JA. Prevention of child obesity: "first, do no harm". Health Educ Res. 2004;20(2):259–65.
17 Brown J, Clarke C, Johnson Stoklossa C, Sievenpiper J. Canadian ddult obesity clinical practice guidelines: medical nutrition therapy in obesity management. 2020 [cited 2022 20 April]; Available from: https://obesitycanada.ca/guidelines/nutrition.
18 Saha AK, Sarkar N, Chatterjee T. Health consequences of childhood obesity. Indian J Pediatr. 2011;78(11):1349–55.
19 McPherson K, Marsh T, Brown M. Foresight report on obesity. The Lancet. 2007;370(9601):1754.
20 New South Wales Ministry of Health. Implementing Routine Growth Assessment of Children: A Toolkit for Local Health Districts. 2018 [24 November 2021]; Available from: https: //pro.healthykids.nsw.gov.au/wp-content/uploads/2018/11/LHD-Toolkit-Implementing-Routine-Growth-Assessment.pdf.

21 Stegenga H, Haines A, Jones K, Wilding J. Identification, assessment, and management of overweight and obesity: summary of updated NICE guidance. Bmj. 2014;349:g6608.
22 National Institute for Clinical Excellence. Lifestyle weight management services for overweight or obese children and young people overview; 2019. Discussion Report.
23 National Health Service, editor. The NHS long term plan. United Kingdom: NHS; 2019.
24 Alman KL, Lister NB, Garnett SP, Gow ML, Aldwell K, Jebeile H. Dietetic management of obesity and severe obesity in children and adolescents: a scoping review of guidelines. Obes Rev. 2021;22(1):e13132.
25 Vlassopoulos A, Govers E, Mulrooney H, Androutsos O, Hassapidou M. Dietetic management of obesity in Europe: gaps in current practice. Eur J Clin Nutr. 2021;75(7):1155–8.
26 Farpour-Lambert NJ, Baker JL, Hassapidou M, Holm JC, Nowicka P, O'Malley G. Childhood obesity is a chronic disease demanding specific health care-a position statement from the Childhood Obesity Task Force (COTF) of the European Association for the Study of Obesity (EASO). Obes Facts. 2015;8(5):342–9.
27 Kirk SFL, Ramos Salas X, Alberga AS, Russell-Mayhew S. Canadian adult obesity clinical practice guidelines: reducing weight bias in obesity management, practice and policy. 2020 [cited 2022 3 Aug]; Available from: https: //obesitycanada.ca/guidelines/weight-bias.
28 Puhl RM, Heuer CA. The stigma of obesity: a review and update. Obesity. 2009;17(5):941–64.
29 Wu YK, Berry DC. Impact of weight stigma on physiological and psychological health outcomes for overweight and obese adults: a systematic review. J Adv Nurs. 2018;74(5):1030–42.
30 Sutin AR, Stephan Y, Terracciano A. Weight discrimination and risk of mortality. Psychol Sci. 2015;26(11):1803–11.
31 Haqq AM, Kebbe M, Tan Q, Manco M, Salas XR. Complexity and stigma of pediatric obesity. Child Obes. 2021;17(4):229–40.
32 Jackson SE, Beeken RJ, Wardle J. Perceived weight discrimination and changes in weight, waist circumference, and weight status. Obesity. 2014;22(12):2485–8.
33 Kirk SFL, Price SL, Penney TL, Rehman L, Lyons RF, Piccinini-Vallis H, et al. Blame, shame, and lack of support: a multilevel study on obesity management. Qual Health Res. 2014;24(6):790–800.
34 Nolan LJ, Eshleman A. Paved with good intentions: paradoxical eating responses to weight stigma. Appetite. 2016;102:15–24.
35 Pearl RL, Puhl RM. The distinct effects of internalizing weight bias: an experimental study. Body Image. 2016;17:38–42.
36 Cassiano GS, Carvalho-Ferreira JP, Buckland NJ, da Cunha DT. Do registered dietitians, nutrition students, and laypeople perceive individuals with obesity differently? Int J Environ Res Public Health. 2021;18(17):8925.
37 Alberga AS, Pickering BJ, Alix Hayden K, Ball GDC, Edwards A, Jelinski S, et al. Weight bias reduction in health professionals: a systematic review. Clin Obes. 2016;6(3):175–88.
38 Wharton S, Lau DC, Vallis M, Sharma AM, Biertho L, Campbell-Scherer D, et al. Obesity in adults: a clinical practice guideline. CMAJ. 2020;192(31):E875–91.
39 Lau DCW, Wharton S. Canadian adult obesity clinical practice guidelines: the science of obesity. 2020. Available from: https://obesitycanada.ca/guidelines/science.
40 Duncanson K, Shrewsbury V, Burrows T, Chai LK, Ashton L, Taylor R, et al. Impact of weight management nutrition interventions on dietary outcomes in children and adolescents with overweight or obesity: a systematic review with meta-analysis. J Hum Nutr Diet. 2021;34(1):147–77.
41 Shrewsbury VA, Steinbeck KS, Torvaldsen S, Baur LA. The role of parents in pre-adolescent and adolescent overweight and obesity treatment: a systematic review of clinical recommendations. Obes Rev. 2011;12(10):759–69.
42 Bean MK, Caccavale LJ, Adams EL, Burnette CB, LaRose JG, Raynor HA, et al. Parent involvement in adolescent obesity treatment: a systematic review. Pediatrics. 2020;146(3):e20193315.
43 Food and Agriculture Organization of the United Nations. Food-based dietary guidelines. 2022 [cited 2022; Available from: https: //www.fao.org/nutrition/education/food-dietary-guidelines/regions/en/.
44 Andela S, Burrows TL, Baur LA, Coyle DH, Collins CE, Gow ML. Efficacy of very low-energy diet programs for weight loss: a systematic review with meta-analysis of intervention studies in children and adolescents with obesity. Obes Rev. 2019;20(6):871–82.
45 Dougkas A, Barr S, Reddy S, Summerbell CD. A critical review of the role of milk and other dairy products in the development of obesity in children and adolescents. Nutr Res Rev. 2019;32(1):106–27.
46 Gow ML, Ho M, Burrows TL, Baur LA, Stewart L, Hutchesson MJ, et al. Impact of dietary macronutrient distribution on BMI and cardiometabolic outcomes in overweight and obese children and adolescents: a systematic review. Nutr Rev. 2014;72(7):453–70.
47 Hoare JK, Jebeile H, Garnett SP, Lister NB. Novel dietary interventions for adolescents with obesity: a narrative review. Pediatr Obes. 2021;16(9):e12798.
48 Lu L, Xun P, Wan Y, He K, Cai W. Long-term association between dairy consumption and risk of childhood obesity: a systematic review and meta-analysis of prospective cohort studies. Eur J Clin Nutr. 2016;70(4):414–23.
49 Steinbeck KS, Lister NB, Gow ML, Baur LA. Treatment of adolescent obesity. Nat Rev Endocrinol. 2018;14(6):331–44.
50 Ells LJ, Rees K, Brown T, Mead E, Al-Khudairy L, Azevedo L, et al. Interventions for treating children and adolescents with overweight and obesity: an overview of Cochrane reviews. Int J Obes. 2018;42(11):1823–33.
51 Holm JC, Nowicka P, Farpour-Lambert NJ, O'Malley G, Hassapidou M, Weiss R. The ethics of childhood obesity treatment-from the Childhood Obesity Task Force (COTF) of European Association for the Study of Obesity (EASO). Obes Facts. 2014;7(4):274–81.
52 Lal A, Peeters A, Brown V, Nguyen P, Tran HNQ, Nguyen T, et al. The modelled population obesity-related health benefits of reducing consumption of discretionary foods in Australia. Nutrients. 2020;12(3):649.
53 Truby H, Baxter K, Ware RS, Jensen DE, Cardinal JW, Warren JM, et al. A randomized controlled trial of two different macronutrient profiles on weight, body composition and metabolic parameters in obese adolescents seeking weight loss. PLoS One. 2016;11(3):e0151787.
54 Leidy HJ, Hoertel HA, Douglas SM, Higgins KA, Shafer RS. A high-protein breakfast prevents body fat gain, through reductions in daily intake and hunger, in "Breakfast skipping" adolescents. Obesity. 2015;23(9):1761–4.
55 Wang S, Yang L, Lu J, Mu Y. High-protein breakfast promotes weight loss by suppressing subsequent food intake and regulating appetite hormones in obese Chinese adolescents. Horm Res Paediatr. 2015;83(1):19–25.
56 Casazza K, Cardel M, Dulin-Keita A, Hanks LJ, Gower BA, Newton AL. A trial of reduced carbohydrate diet to improve metabolic outcomes and decrease adiposity in obese peripubertal African American girls: does macronutrient profile matter? J Pediatr Gastroenterol Nutr. 2012;54(3):336–42.
57 Gow ML, Baur LA, Ho M, Chisholm K, Noakes M, Cowell CT. Can early weight loss, eating behaviors and socioeconomic factors predict successful weight loss at 12-and 24-months in adolescents with obesity and insulin resistance participating in a randomised controlled trial? Int J Behav Nutr Phys Act. 2016;13(1):43–11.
58 Partsalaki I, Karvela A, Spiliotis BE. Metabolic impact of a ketogenic diet compared to a hypocaloric diet in obese children and adolescents. J Pediatr Endocrinol Metab. 2012;25(7–8):697–704.
59 Armeno ML, Krochik AG, Mazza CS. Evaluation of two dietary treatments in obese hyperinsulinemic adolescents. J Pediatr Endocrinol Metab. 2011;24(9–10):715–22.
60 Parillo M, Licenziati MR, Vacca M, De Marco D, Iannuzzi A. Metabolic changes after a hypocaloric, low-glycemic-index diet in obese children. J Endocrinol Invest. 2012;35(7):629–33.
61 Kong AP, Choi KC, Chan RS, Lok K, Ozaki R, Li AM, et al. A randomized controlled trial to investigate the impact of a low glycemic index (GI) diet on body mass index in obese adolescents. BMC Public Health. 2014;14(1):180.

62 de Ferranti SD, Milliren CE, Denhoff ER, Quinn N, Osganian SK, Feldman HA. Providing food to treat adolescents at risk for cardiovascular disease. Obesity. 2015;23(10):2109–17.
63 Kirk S, Brehm B, Saelens BE, Woo JG, Kissel E, D'Alessio D, et al. Role of carbohydrate modification in weight management among obese children: a randomized clinical trial. J Pediatr. 2012;161(2):320–7.e1.
64 Mirza NM, Palmer MG, Sinclair KB, McCarter R, He J, Ebbeling CB. Effects of a low glycemic load or a low-fat dietary intervention on body weight in obese Hispanic American children and adolescents: a randomized controlled trial. Am J Clin Nutr. 2013;97(2):276–85.
65 Bonham MP, Dordevic AL, Ware RS, Brennan L, Truby H. Evaluation of a commercially delivered weight management program for adolescents. J Pediatr. 2017;185:73–80.e3.
66 Chan DFY, So HK, Hui SCN, Chan RSM, Li AM, Sea MM, et al. Dietitian-led lifestyle modification programme for obese Chinese adolescents with non-alcoholic fatty liver disease: a randomized controlled study. Int J Obes. 2018;42(9):1680–90.
67 Mazzeo SE, Kelly NR, Stern M, Gow RW, Cotter EW, Thornton LM, et al. Parent skills training to enhance weight loss in overweight children: evaluation of NOURISH. Eat Behav. 2014;15(2):225–9.
68 Nemet D, Barkan S, Epstein Y, Friedland O, Kowen G, Eliakim A. Short- and long-term beneficial effects of a combined dietary-behavioral-physical activity intervention for the treatment of childhood obesity. Pediatrics. 2005;115(4):e443–9.
69 Tsiros MD, Sinn N, Brennan L, Coates AM, Walkley JW, Petkov J, et al. Cognitive behavioral therapy improves diet and body composition in overweight and obese adolescents. Am J Clin Nutr. 2008;87(5):1134–40.
70 Ojeda-Rodríguez A, Zazpe I, Morell-Azanza L, Chueca M, Azcona-sanjulian M, Marti A. Improved diet quality and nutrient adequacy in children and adolescents with abdominal obesity after a lifestyle intervention. Nutrients. 2018;10(10):1500.
71 Tjonna AE, Stolen T, Bye A, Volden M, Slordahl S, Odegard R, et al. Aerobic interval training reduces cardiovascular risk factors more than a multitreatment approach in overweight adolescents. Clin Sci. 2009;116(4):317–26.
72 Okely AD, Collins CE, Morgan PJ, Jones RA, Warren JM, Cliff DP, et al. Multi-site randomized controlled trial of a child-centered physical activity program, a parent-centered dietary-modification program, or both in overweight children: the HIKCUPS study. J Pediatr. 2010;157(3):388–94.e1.
73 Collins CE, Okely AD, Morgan PJ, Jones RA, Burrows TL, Cliff DP, et al. Parent diet modification, child activity, or both in obese children: an RCT. Pediatrics. 2011;127(4):619–27.
74 Md Yusop NB, Mohd Shariff Z, Hwu TT, Abd. Talib R, Spurrier N. The effectiveness of a stage-based lifestyle modification intervention for obese children. BMC Public Health. 2018;18(1):299.
75 Rhodes ET, Vernacchio L, Mitchell AA, Fischer C, Giacalone P, Ludwig DS. A telephone intervention to achieve differentiation in dietary intake: a randomized trial in paediatric primary care. Pediatr Obes. 2017;12(6):494–501.
76 White MA, Martin PD, Newton RL, Walden HM, York-Crowe EE, Gordon ST, et al. Mediators of weight loss in a family-based intervention presented over the internet. Obes Res. 2004;12(7):1050–9.
77 Macknin M, Kong T, Weier A, Worley S, Tang AS, Alkhouri N. Plant-based, no-added-fat or American Heart Association diets: impact on cardiovascular risk in obese children with hypercholesterolemia and their parents. J Pediatr. 2015;166(4):953–9.e3.
78 Gunnarsdottir T, Sigurdardottir ZG, Njardvik U, Olafsdottir AS, Bjarnason R. A randomized-controlled pilot study of Epstein's family-based behavioural treatment for childhood obesity in a clinical setting in Iceland. Nordic Psychol. 2011;63(1):6–19.
79 Serra-Paya N, Ensenyat A, Castro-Vinuales I, Real J, Sinfreu-Bergues X, Zapata A, et al. Effectiveness of a multi-component intervention for overweight and obese children (nereu program): a randomized controlled trial. PLoS ONE. 2015;10(12):e0144502.
80 Tomayko EJ, Prince RJ, Cronin KA, Adams AK. The Healthy Children, Strong Families intervention promotes improvements in nutrition, activity and body weight in American Indian families with young children. Public Health Nutr. 2016;19(15):2850–9.
81 Raynor HA, Osterholt KM, Hart CN, Jelalian E, Vivier P, Wing RR. Efficacy of US paediatric obesity primary care guidelines: two randomized trials. Pediatr Obes. 2012;7(1):28–38.
82 Burrows T, Janet WM, Collins CE. Long-term changes in food consumption trends in overweight children in the HIKCUPS intervention. J Pediatr Gastroenterol Nutr. 2011;53(5):543–7.
83 Stovitz SD, Berge JM, Wetzsteon RJ, Sherwood NE, Hannan PJ, Himes JH. Stage 1 treatment of pediatric overweight and obesity: a pilot and feasibility randomized controlled trial. Child Obes. 2014;10(1):50–7.
84 Garipagaoglu M, Sahip Y, Darendeliler F, Akdikmen O, Kopuz S, Sut N. Family-based group treatment versus individual treatment in the management of childhood obesity: randomized, prospective clinical trial. Eur J Pediatr. 2009;168(9):1091–9.
85 Nguyen B, Shrewsbury VA, O'Connor J, Steinbeck KS, Hill AJ, Shah S, et al. Two-year outcomes of an adjunctive telephone coaching and electronic contact intervention for adolescent weight-loss maintenance: the Loozit randomized controlled trial. Int J Obes. 2013;37(3):468–72.
86 van Grieken A, Renders CM, Veldhuis L, Looman CW, Hirasing RA, Raat H. Promotion of a healthy lifestyle among 5-year-old overweight children: health behavior outcomes of the "Be active, eat right" study. BMC Public Health. 2014;14(1):59.
87 Calleja M, Caetano Feitoza N, Falk B, Klentrou P, Ward WE, Sullivan PJ. Increased dairy product consumption as part of a diet and exercise weight management program improves body composition in adolescent females with overweight and obesity: a randomized controlled trial. Pediatr Obes. 2020;15(12):e12690.
88 Cohen TR, Hazell TJ, Vanstone CA, Rodd C, Weiler HA. A family-centered lifestyle intervention for obese six-to eight-year-old children: results from a one-year randomized controlled trial conducted in Montreal, Canada. Can J Public Health. 2016;107(4–5):e453–e460.
89 Esfarjani F, Khalafi M, Mohammadi F, Mansour A, Roustaee R, Zamani-Nour N. Family-based intervention for controlling childhood obesity: an experience among iranian children. Int J Prev Med. 2013;4(3):358–65.
90 Wilson TA, Liu Y, Adolph AL, Sacher PM, Barlow SE, Pont S, et al. Behavior modification of diet and parent feeding practices in a community- vs primary care–centered intervention for childhood obesity. J Nutr Educ Behav. 2019;51(2):150–61.e1.
91 Wengle JG, Hamilton JK, Manlhiot C, Bradley TJ, Katzman DK, Sananes R, et al. The "Golden Keys" to health: a healthy lifestyle intervention with randomized individual mentorship for overweight and obesity in adolescents. Paed Child Health. 2011;16(8):473–8.
92 Moschonis G, Michalopoulou M, Tsoutsoulopoulou K, Vlachopapadopoulou E, Michalacos S, Charmandari E, et al. Assessment of the effectiveness of a computerised decision-support tool for health professionals for the prevention and treatment of childhood obesity. Results from a randomised controlled trial. Nutrients. 2019;11(3):706.
93 Epstein LH, Kilanowski C, Paluch RA, Raynor H, Daniel TO. Reducing variety enhances effectiveness of family-based treatment for pediatric obesity. Eat Behaviors. 2015;17:140–3.
94 Ebbeling CB, Feldman HA, Chomitz VR, Antonelli TA, Gortmaker SL, Osganian SK. A randomized trial of sugar-sweetened beverages and adolescent body weight. N Engl J Med. 2012;367(15):1407–16.
95 Epstein LH, Paluch RA, Kilanowski CK, Raynor HA. The effect of reinforcement or stimulus control to reduce sedentary behavior in the treatment of pediatric obesity. Health Psychol. 2004;23(4):371–80.
96 Reinehr T, Schaefer A, Winkel K, Finne E, Toschke A, Kolip P. An effective lifestyle intervention in overweight children: findings from a randomized controlled trial on "Obeldicks light". Clin Nutr. 2010;29(3):331–6.

97 Duffy G, Spence SH. The effectiveness of cognitive self-management as an adjunct to a behavioural intervention for childhood obesity: a research note. J Child Psychol Psychiat. 1993;34(6):1043–50.
98 Graves T, Meyers AW, Clark L. An evaluation of parental problem-solving training in the behavioral treatment of childhood obesity. J Consulting Clin Psychol. 1988;56(2):246–50.
99 Davis JN, Tung A, Chak SS, Ventura EE, Byrd-Williams CE, Alexander KE, et al. Aerobic and strength training reduces adiposity in overweight Latina adolescents. Med Sci Sports Exerc. 2009;41(7):1494–503.
100 Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year outcomes of behavioral family-based treatment for childhood obesity. Health Psychol. 1994;13(5):373–83.
101 Goldfield GS, Epstein L, Kilanowski C, Paluch R, Kogut-Bossler B. Cost-effectiveness of group and mixed family-based treatment for childhood obesity. Int J Obes. 2001;25(12):1843–9.
102 DeBar LL, Stevens VJ, Perrin N, Wu P, Pearson J, Yarborough BJ, et al. A primary care-based, multicomponent lifestyle intervention for overweight adolescent females. Pediatrics. 2012;129(3):e611–20.
103 Pakpour AH, Gellert P, Dombrowski SU, Fridlund B. Motivational interviewing with parents for obesity: an RCT. Pediatrics. 2015;135(3):e644–52.
104 Wong JMW, Ebbeling CB, Robinson L, Feldman HA, Ludwig DS. Effects of advice to drink 8 cups of water per day in adolescents with overweight or obesity: a randomized clinical trial. JAMA Pediatr. 2017;171(5):e170012.
105 Kobes A, Kretschmer T, Timmerman G, Schreuder P. Interventions aimed at preventing and reducing overweight/obesity among children and adolescents: a meta-synthesis. Obes Rev. 2018;19(8):1065–79.
106 Luna-Pech JA, Torres-Mendoza BM, Luna-Pech JA, Garcia-Cobas CY, Navarrete-Navarro S, Elizalde-Lozano AM. Normocaloric diet improves asthma-related quality of life in obese pubertal adolescents. Int Arch Allergy Immunol. 2014;163(4):252–8.
107 Jensen ME, Gibson PG, Collins CE, Hilton JM, Wood LG. Diet-induced weight loss in obese children with asthma: a randomized controlled trial. Clin Exp Allergy. 2013;43(7):775–84.
108 Mendes MDSD, de Melo ME, Fernandes AE, Fujiwara CTH, Pioltine MB, Teixeira A, et al. Effects of two diet techniques and delivery mode on weight loss, metabolic profile and food intake of obese adolescents: a fixed diet plan and a calorie-counting diet. Eur J Clin Nutr. 2016;71(4):549–51.
109 Duncanson K, et al. Interim report on the effectiveness of dietary interventions for children and adolescents with overweight and obesity for the world health organization WHO; 2017.
110 Patsopoulou A, Tsimtsiou Z, Katsioulis A, Malissiova E, Rachiotis G, Hadjichristodoulou C. Evaluating the efficacy of the feeding exercise randomized trial in overweight and obese adolescents. Child Obes. 2017;13(2):128–37.
111 Akgul Gundogdu N, Sevig EU, Guler N. The effect of the solution-focused approach on nutrition–exercise attitudes and behaviours of overweight and obese adolescents: randomised controlled trial. J Clin Nurs. 2018;27(7–8):e1660–e1672.
112 Amiri P, Jalali-Farahani S, Zarkesh M, Gharibzadeh S, Hedayati M, Azizi F. Behavioral interventions for weight management in overweight and obese adolescents: a comparison between a motivation-based educational program and conventional dietary counseling. Int J Endocrinol Metab. 2020;18(1):e88192.
113 Bean MK, Ingersoll KS, Powell P, Stern M, Evans RK, Wickham EP. Impact of motivational interviewing on outcomes of an adolescent obesity treatment: results from the MI Values randomized controlled pilot trial. Clin Obes. 2018;8(5):323–6.
114 Köse S, Yıldız S. Motivational support programme to enhance health and well-being and promote weight loss in overweight and obese adolescents: a randomized controlled trial in Turkey. Int J Nurs Pract. 2021;27(1):e12878.
115 Taveras EM. Randomized controlled trial to improve primary care to prevent and manage childhood obesity: the High Five for Kids study. Arch Pediatr Adolesc Med. 2011;165(8):714–22.
116 Borrello M, Pietrabissa G, Ceccarini M, Manzoni GM, Castelnuovo G. Motivational interviewing in childhood obesity treatment. Front Psychol. 2015;6:1732.
117 Azevedo LB, Stephenson J, Ells L, Adu-Ntiamoah S, DeSmet A, Giles EL, et al. The effectiveness of e-health interventions for the treatment of overweight or obesity in children and adolescents: a systematic review and meta-analysis. Obes Rev. 2022;23(2):e13373.
118 Small L, Bonds-McClain D, Melnyk B, Vaughan L, Gannon AM. The preliminary effects of a primary care: based randomized treatment trial with overweight and obese young children and their parents. J Pediatr Health Care. 2014;28(3):198–207.
119 Looney SM, Raynor HA. Examining the effect of three low-intensity pediatric obesity interventions: a pilot randomized controlled trial. Clin Pediatr. 2014;53(14):1367–74.
120 Larsen LM, Hertel NT, Molgaard C, Christensen RD, Husby S, Jarbol DE. Early intervention for childhood overweight: a randomized trial in general practice. Scand J Prim Health Care. 2015;33(3):184–90.
121 Larsen KT, Huang T, Ried-Larsen M, Andersen LB, Heidemann M, Moller NC. A multi-component day-camp weight-loss program is effective in reducing BMI in children after one year: a randomized controlled trial. PLoS One. 2016;11(6):e0157182.
122 Parra-Medina D, Mojica C, Liang Y, Ouyang Y, Ramos AI, Gomez I. Promoting weight maintenance among overweight and obese Hispanic children in a rural practice. Child Obes. 2015;11(4):355–63.
123 Resnicow K, McMaster F, Bocian A, Harris D, Zhou Y, Snetselaar L, et al. Motivational interviewing and dietary counseling for obesity in primary care: an RCT. Pediatrics. 2015;135(4):649–57.
124 Banks J, Sharp DJ, Hunt LP, Shield JP. Evaluating the transferability of a hospital-based childhood obesity clinic to primary care: a randomised controlled trial. Br J Gen Pract. 2012;62(594):e6–e12.
125 Berkowitz RI, Rukstalis MR, Bishop-Gilyard CT, Moore RH, Gehrman CA, Xanthopoulos MS, et al. Treatment of adolescent obesity comparing self-guided and group lifestyle modification programs: a potential model for primary care. J Pediatr Psychol. 2013;38(9):978–86.
126 Verduci E, Banderali G, Di Profio E, Vizzuso S, Zuccotti G, Radaelli G. Effect of individual-versus collective-based nutritional-lifestyle intervention on the atherogenic index of plasma in children with obesity: a randomized trial. Nutr Metab. 2021;18(1):11–.
127 Kelly JT, Allman-Farinelli M, Chen J, Partridge SR, Collins C, Rollo M, et al. Dietitians Australia position statement on telehealth. Nutr Diet. 2020;77(4):406–15.
128 Woo Baidal JA, Chang J, Hulse E, Turetsky R, Parkinson K, Rausch JC. Zooming toward a telehealth solution for vulnerable children with obesity during coronavirus disease 2019. Obesity. 2020;28(7):1184–6.
129 Fleary SA, Ettienne R. The relationship between food parenting practices, parental diet and their adolescents' diet. Appetite. 2019;135:79–85.
130 Lister NB, Gow ML, Chisholm K, Grunseit A, Garnett SP, Baur LA. Nutritional adequacy of diets for adolescents with overweight and obesity: considerations for dietetic practice. Eur J Clin Nutr. 2017;71(5):646–51.
131 Safavi M, Farajian S, Kelishadi R, Mirlohi M, Hashemipour M. The effects of synbiotic supplementation on some cardio-metabolic risk factors in overweight and obese children: a randomized triple-masked controlled trial. Int J Food Sci Nutr. 2013;64(6):687–93.
132 Stagi S, Lapi E, Romano S, Bargiacchi S, Brambilla A, Giglio S, et al. Determinants of vitamin d levels in children and adolescents with down syndrome. Int J Endocrinol. 2015;2015:1–11.

133 Berkowitz RI, Wadden TA, Gehrman CA, Bishop-Gilyard CT, Moore RH, Womble LG, et al. Meal replacements in the treatment of adolescent obesity: a randomized controlled trial. Obesity. 2011;19(6):1193–9.
134 O'Brien PE, Sawyer SM, Laurie C, Brown WA, Skinner S, Veit F, et al. Laparoscopic adjustable gastric banding in severely obese adolescents: a randomized trial. Jama. 2010; 303(6):519–26.
135 Ulian MD, Aburad L, da Silva Oliveira MS, Poppe ACM, Sabatini F, Perez I, et al. Effects of health at every size® interventions on health-related outcomes of people with overweight and obesity: a systematic review. Obes Rev. 2018;19(12):1659–66.
136 Raffoul A, Williams L. Integrating health at every size principles into adolescent care. Curr Opin Pediatr. 2021;33(4):361–7.
137 Gow ML, Tee MSY, Garnett SP, Baur LA, Aldwell K, Thomas S, et al. Pediatric obesity treatment, self-esteem, and body image: a systematic review with meta-analysis. Pediatr Obes. 2020;15(3):e12600.
138 Goldtooth-Halwood R. A systematic review of the recent consumption levels of sugar-sweetened beverages in children and adolescents from the world health organization regions with high dietary–related burden of disease. Asia Pac J Public Health. 2022;34(6–7):723–4.
139 Serra-Majem L, Tomaino L, Dernini S, Berry EM, Lairon D, Ngo de la Cruz J, et al. Updating the mediterranean diet pyramid towards sustainability: focus on environmental concerns. Int J Environ Res Public Health. 2020; 17(23):8758.
140 von Philipsborn P, Stratil JM, Burns J, Busert LK, Pfadenhauer LM, Polus S, et al. Environmental interventions to reduce the consumption of sugar-sweetened beverages and their effects on health. Cochrane Database Syst Rev. 2016(6).
141 EFSA panel on dietetic products, N. And allergies, Scientific opinion on dietary reference values for water. EFSA Journal; 2010; 8(3): p. 1459.
142 Collins CE, Warren JM, Neve M, McCoy P, Stokes B. Systematic review of interventions in the management of overweight and obese children which include a dietary component. Int J Evidence-Based Healthc. 2007;5(1):2–53.
143 Ho M, Jensen ME, Burrows T, Neve M, Garnett SP, Baur L, et al. Best practice dietetic management of overweight and obese children and adolescents: a 2010 update of a systematic review. JBI Database Syst Rev Implementation Rep. 2013; 11(10):190–293.
144 Shrewsbury VA, Burrows T, Ho M, Jensen M, Garnett SP, Stewart L, et al. Update of the best practice dietetic management of overweight and obese children and adolescents: a systematic review protocol. JBI Database Syst Rev Implementation Rep. 2018;16(7): 1495–502.
145 Joanna Briggs Institute. Critical appraisal tools: checklist for randomised controlled trials; 2017.
146 Shekelle P, Woolf S, Grimshaw JM, Schunemann HJ, Eccles MP. Developing clinical practice guidelines: reviewing, reporting, and publishing guidelines; updating guidelines; and the emerging issues of enhancing guideline implementability and accounting for comorbid conditions in guideline development. Implementation Sci. 2012;7(1):62–7.
147 Shekelle PG, Woolf SH, Eccles M, Grimshaw J. Developing clinical guidelines. West J Med. 1999;170(6):348–51.